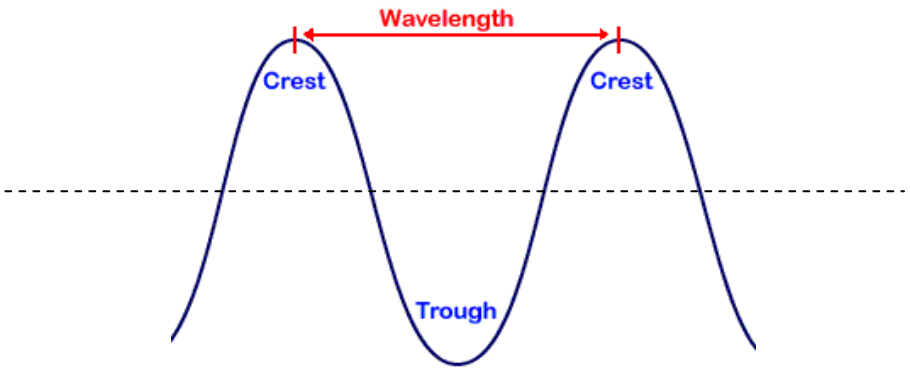
Light Waves

There are many different kinds of waves. Waves are the way energy moves from place to place. **Sound waves** let us hear someone talking as sound waves move from our mouth to someone's ear. **Light waves** let us see when it's dark as light waves move from a light bulb to a dark room to our eyes.

The Basic Parts of a Transverse Wave

Light reaches us on **transverse waves**. As we can see in Diagram 1, the high point of a transverse wave is called the **crest** while the low point is called the **trough**. Waves can be measured in **wavelengths**. A wavelength is the difference between one wave crest (or trough) to the next wave crest (or trough). Wavelength can be measured from any point on a wave as long as it is measured to the same point on the next wave.

Diagram 1: A Transverse Wave



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How Light Travels

Scientists have discovered that light travels in both waves and as tiny particles called **photons**. In both wave and particle (photon) form, light is energy. Light waves travel in straight paths called **rays**. Unlike sound, where waves have to travel through matter to be heard, light waves do not have to travel through matter to be seen. Instead, rays travel in a straight path until they hit an object. A ray's straight path is the *path* of light. Parallel rays grouped together represent a *beam* of light.

Opaque, Transparent, and Translucent

When a light wave hits an object it will either bounce off (**reflection**), bend (**refraction**), pass through (**transmitted**), or be **absorbed** as heat. Some objects transmit light waves better than others. **Opaque** materials do not allow light waves to pass through. Reynolds wrap is an example of an opaque material. **Translucent** materials allow light to pass through but not in a straight path. Wax paper is an example of a translucent material. **Transparent** materials allow light waves to pass through easily. Clear glass is an example of a transparent material.

Light Waves

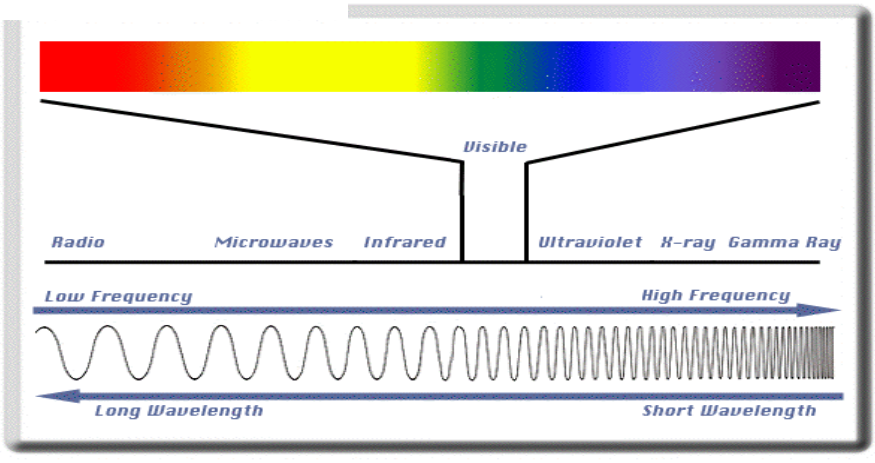
The Visible Spectrum

Light waves, as compared to sound waves, are extremely fast (186,000 meters/second). In fact, it only takes light from the Sun less than eight and a half minutes to travel 150 million kilometers or 93 million miles to Earth. Light waves move as transverse waves (see diagram of a transverse wave) and can move through a vacuum (empty space) at a speed of approximately 186,000 miles per second.

Light has both magnetic and electric fields. Scientists call this **electromagnetic radiation** (light). Sunlight consists of the entire electromagnetic spectrum. The only difference between the different types of electromagnetic radiation is the amount of energy. The wavelengths we can see with our eyes makes up a very small part of the electromagnetic radiation spectrum. We see visible light as the colors of the rainbow. These "visible" waves make up the **visible spectrum**.

Each of these visible waves is a different **wavelength** and our eye sees each one as a different color. The longest wave that we can see is called the color **red**. The shortest wave that we can see is called the color **violet**. The waves that make up the visible spectrum are **red, orange, yellow, green, blue, and violet (ROYGBV)**.

Diagram 2: The Visible Spectrum



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Frequency

Electromagnetic radiation (light energy from the Sun) can be identified by its wavelength as well as the **frequency** of its wavelength. The frequency is the number of waves passing a given point in one second. If the frequency increases, the amount of energy increases. In the visible light spectrum (see Diagram 2), violet has the greatest frequency and the most energy. The red wavelength has the lowest frequency and the lowest amount of energy.

Reflection of Light

Diagram 3: The Visible Spectrum

As we can see in the [illegible] spectrum. That's because black is not actually a color. Black is the total absence of color or reflected light. We see black when a material, such as a driveway, absorbs all the visible light and no light is reflected back. White is not a color either. White is actually a reflection of all the colors of the visible light spectrum. In fact visible light, or the mix of ROYGBV, is sometimes referred to as **white light**.

Refraction of Light

To see the different colors that make up white light, we need to use a **prism**. When white light passes through a glass prism, it **bends** and changes direction. This bending of light is called **refraction**. Each of the waves in the visible spectrum bends differently, so we see different colors. Water droplets in the atmosphere act as tiny "natural" **prisms** after a rainstorm. When sunlight passes through them we see a rainbow!